

Australian/New Zealand Standard™

Parking facilities

Part 1: Off-street car parking



AS/NZS 2890.1:2004

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee CE-001, Parking Facilities. It was approved on behalf of the Council of Standards Australia on 12 January 2004 and on behalf of the Council of Standards New Zealand on 23 February 2005.

This Standard was published on 5 March 2004.

The following are represented on Committee CE-001:

ACT Department of Urban Services
Association of Consultants in Access Australia
Australian Building Codes Board
Disabled Persons Assembly New Zealand
Institute of Public Works Engineering Australia
Institution of Engineers Australia
Institution of Professional Engineers New Zealand
Local Government New Zealand
Main Roads Department, Queensland
Monash University
New Zealand Automobile Association
Parking Association of Australia
Property Council of Australia
Property Council of New Zealand
Roads and Traffic Authority of NSW

Keeping Standards up-to-date

Standards are living documents which reflect progress in science, technology and systems. To maintain their currency, all Standards are periodically reviewed, and new editions are published. Between editions, amendments may be issued. Standards may also be withdrawn. It is important that readers assure themselves they are using a current Standard, which should include any amendments which may have been published since the Standard was purchased.

Detailed information about joint Australian/New Zealand Standards can be found by visiting the Standards Web Shop at www.standards.com.au or Standards New Zealand web site at www.standards.co.nz and looking up the relevant Standard in the on-line catalogue.

Alternatively, both organizations publish an annual printed Catalogue with full details of all current Standards. For more frequent listings or notification of revisions, amendments and withdrawals, Standards Australia and Standards New Zealand offer a number of update options. For information about these services, users should contact their respective national Standards organization.

We also welcome suggestions for improvement in our Standards, and especially encourage readers to notify us immediately of any apparent inaccuracies or ambiguities. Please address your comments to the Chief Executive of either Standards Australia or Standards New Zealand at the address shown on the back cover.

This Standard was issued in draft form for comment as DR 02352.

Australian/New Zealand Standard™

Parking facilities

Part 1: Off-street car parking

Originated as AS 2890.1—1986.
Previous edition 1993.
Jointly revised and designated as AS/NZS 2890.1:2004.
Reissued incorporating Amendment No. 1 (August 2005).

COPYRIGHT

© Standards Australia/Standards New Zealand

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher.

Jointly published by Standards Australia, GPO Box 476, Sydney, NSW 2001 and Standards New Zealand, Private Bag 2439, Wellington 6020

ISBN 0 7337 5742 1

PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee CE-001, Parking Facilities and supersedes AS 2890.1—1993, *Parking facilities, Part 1: Off-street car parking*.

This Standard incorporates Amendment No. 1 (August 2005). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.

It is one of a series of Standards on parking facilities as follows:

AS/NZS

- | | |
|--------|--|
| 2890 | Parking facilities |
| 2890.1 | Part 1: Off-street car parking (this Standard) |
| 2890.6 | Part 6: Off-street parking for people with disabilities* |

AS

- | | |
|--------|--|
| 2890 | Parking facilities |
| 2890.2 | Part 2: Off-street commercial vehicle facilities |
| 2890.3 | Part 3: Bicycle parking facilities |
| 2890.5 | Part 5: On-street parking |

The objective of this Standard is to provide planners, designers and regulatory bodies with requirements and recommendations for the design and layout of off-street parking facilities.

The following lists the principal changes and additions to this edition of the Standard:

- (a) Publication as a Joint Australia/New Zealand Standard. Where requirements or recommendations apply only to Australia or only to New Zealand, these are indicated in the text or on illustrations.
- (b) Addition of two new user classes, the first aimed at relaxing manoeuvre space requirements to reach parking spaces in residential properties and the second, to increase aisle width requirements at certain high turnover parking areas.
- (c) Expanded detail on parallel parking in parking aisles.
- (d) Changes in ramp grade requirements for private/residential car parks and for parking on domestic properties.
- (e) A reappraisal of design vehicle characteristics and dimensions which includes an increase in the minimum vehicle ground clearance from 100 mm to 120 mm.

The terms 'normative' and 'informative' have been used in this Standard to define the application of the appendix to which they apply. A 'normative' appendix is an integral part of a Standard, whereas an 'informative' appendix is only for information and guidance.

Statements expressed in mandatory terms in notes to tables and figures are deemed to be requirements of this Standard.

* In preparation. See footnote to Clause 1.2.

CONTENTS

	<i>Page</i>
FOREWORD.....	4
SECTION 1 SCOPE AND GENERAL	
1.1 SCOPE	5
1.2 REFERENCED DOCUMENTS	5
1.3 DEFINITIONS	6
1.4 CLASSIFICATION OF OFF-STREET CAR PARKING FACILITIES.....	8
SECTION 2 DESIGN OF PARKING MODULES, CIRCULATION ROADWAYS AND RAMP	
2.1 GENERAL	10
2.2 GENERAL DESCRIPTION	10
2.3 PRELIMINARY DESIGN CONSIDERATIONS	11
2.4 DESIGN OF PARKING MODULES	13
2.5 DESIGN OF CIRCULATION ROADWAYS AND RAMP	22
2.6 DESIGN OF DOMESTIC DRIVEWAYS	27
SECTION 3 ACCESS FACILITIES TO OFF-STREET PARKING AREAS AND QUEUING AREAS	
3.1 GENERAL	28
3.2 ACCESS DRIVEWAYS—WIDTH AND LOCATION.....	28
3.3 GRADIENTS OF ACCESS DRIVEWAYS.....	33
3.4 QUEUING AREAS	34
3.5 ACCESS TO MECHANICAL PARKING INSTALLATIONS	35
SECTION 4 OTHER CONSIDERATIONS	
4.1 PEDESTRIAN SERVICE.....	36
4.2 BICYCLE PARKING.....	36
4.3 SIGNPOSTING	36
4.4 PAVEMENT MARKINGS.....	41
4.5 PARCEL PICK-UP.....	43
4.6 SHOPPING TROLLEY REQUIREMENTS	43
4.7 LIGHTING	44
4.8 LANDSCAPING	44
4.9 HUMPS	45
4.10 SPECIAL LOADING/UNLOADING PARKING SPACES	46
SECTION 5 ADDITIONAL REQUIREMENTS FOR CAR PARKING STRUCTURES	
5.1 GENERAL	47
5.2 COLUMN LOCATION AND SPACING	47
5.3 HEADROOM	48
5.4 DESIGN OF ENCLOSED GARAGES	49
APPENDICES	
A DESIGN VEHICLE CHARACTERISTICS AND DIMENSIONS	52
B BASE DIMENSIONS AND DESIGN STANDARDS	56
C GROUND CLEARANCE TEMPLATES	69
D CAPACITY PROVISION AT ENTRY AND EXITS AT LARGE CAR PARKS.....	71

FOREWORD

As an integral part of transportation, provision for car parking is vital to the economic life of communities, whether it is in city central business districts, town business centres, shopping centres, hospitals, department stores, entertainment and sporting facilities, or other traffic generators. Parking areas must also cater for bicycles, motorcycles, pedestrians, and other legitimate users.

The basic dimensions for parking spaces, aisles, circulation roadways and other manoeuvring areas given in this Standard have been determined firstly by an examination of the dimensions of vehicles in the current range, and the selection of an 85th percentile and a 99.8th percentile vehicle (see Appendix A). Following this, a set of base dimensions based on requirements for the so-called B85 and B99 vehicles has been established, and a set of design dimensions has been derived by the addition of working clearances (see Appendix B). The concept of 'parking module' has been adopted to ensure that parking space width and length are properly related to aisle width.

The success of a parking development requires an efficient design. It must represent a balance between function, economics, safety and aesthetics. Consideration must be given to the speed and quality of parking service, the traffic circulation, access to and from the street, the external traffic network, car manoeuvring, and convenience for the drivers and pedestrians, including people with disabilities.

Although it provides minimum requirements, this Standard cannot be taken as a textbook for the design of parking stations. The services of a qualified person experienced in designing car parking facilities should be sought in the application of this document. Moreover, its use does not remove the need to comply with regulatory requirements of local government.

STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard
Parking facilities

Part 1: Off-street car parking

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard sets out the minimum requirements for the design and layout of off-street parking facilities, including multi-storey car parks for motor cars, light vans and motorcycles. It includes access and egress requirements for both public and private car parks, and car parking on domestic properties.

1.2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

- 1348 Glossary of terms—Road and traffic engineering
- 1680 Interior lighting
- 1680.2.1 Part 2.1: Circulation spaces and other general areas
- 1742 Manual of uniform traffic control devices
- 1742.1 Part 1: General introduction and index of signs
- 1742.2 Part 2: Traffic control devices for general use
- 1742.10 Part 10: Pedestrian control and protection
- 1742.13 Part 13: Local area traffic management
- 1744 Forms of letters and numerals for road signs
- 2890 Parking facilities
- 2890.3 Part 3: Bicycle parking facilities

AS/NZS

- 1158 Road lighting
- 1158.3.1 Part 3.1: Pedestrian area (Category P) lighting—Performance and installation design requirements
- 1170 Structural design actions
- 1170.1 Part 1: Permanent, imposed and other actions

AS/NZS

2890 Parking facilities

2890.6 Part 6: Off-street parking for people with disabilities*

4586 Slip resistance classification of new pedestrian surface materials

ADR

43 Australian design rules for vehicle configuration and dimensions

Land Transport Safety Authority, New Zealand and Transit New Zealand

Manual of Traffic Signs and Markings

1.3 DEFINITIONS

For the purpose of this Standard, the definitions given in AS 1348 and the following apply.

1.3.1 Access driveway

A roadway extending from the edge of the frontage roadway to the property boundary to connect with the first ramp, circulation roadway, parking aisle or domestic driveway encountered, and carrying one- or two-way traffic (see Figure 2.1).

1.3.2 Accessible entrance

An entrance to a facility or establishment served by the car park, suitable for pedestrian or wheelchair use by people with disabilities.

1.3.3 Accessible travel path

An uninterrupted path of travel to or within a building providing pedestrian or wheelchair access for people with disabilities from a parking space to all required facilities.

1.3.4 Base dimension

The value of a particular design dimension before any operating clearances have been added.

1.3.5 Blind aisle

A parking aisle closed at one end.

1.3.6 B85 vehicle

The design motor car whose physical dimensions represent the 85th percentile class of all cars and light vans on the road (see Appendix B, Paragraph B2).

1.3.7 B99 vehicle

The design motor car whose physical dimensions represent the 99.8th percentile class of all cars and light vans on the road (see Appendix B, Paragraph B2).

1.3.8 Circulation clearance

The clearance required in addition to manoeuvring clearances, when a vehicle is moving at speeds greater than those applicable to manoeuvring.

* In preparation. This edition of this Standard has been published without the inclusion of requirements for parking facilities for people with disabilities. As these requirements are to be referenced in the proposed Disability Standards for Access to Premises (the Premises Standard), to be released for public comment by the Australian Building Codes Board (ABCB) at about the time of publication of this Standard, Standards Australia has been advised by that Board to delay publication of those requirements in the Australian/New Zealand Standard until its public comment process has been completed. These requirements are therefore expected to be published at an appropriate later date as a separate Standard to be numbered AS/NZS 2890.6. Pending such publication it is intended that existing requirements for parking for people with disabilities in AS 2890.1—1993, which has been made ‘available superseded’, will be observed. Subject to further confirmation from New Zealand interests, Part 6 may be published as an Australian only standard.

1.3.9 Circulation roadway

A roadway within an off-street car park which is used solely for circulation and to gain access to parking aisles, and on which there is no parking (see Figure 2.1).

1.3.10 Collector road

A non-arterial road which collects and distributes traffic in an area, as well as serving abutting properties.

1.3.11 Control point

A point at or near the entrance to or exit from a car park at which the flow of traffic is retarded by the existence of a boom barrier, with or without ticket or cashier operation, or the location of the first of any spaces on a parking aisle at which parking or unparking may cause traffic flow to be retarded.

1.3.12 Domestic driveway

A vehicular path within a domestic property.

1.3.13 Domestic property

A property comprising three or less domestic units.

1.3.14 Front overhang

The distance between the centre-line of the front axle of a vehicle and the front extremity of the bodywork.

1.3.15 Local road

A road or street used primarily for access to abutting properties.

1.3.16 Parking aisle

A roadway or an area of pavement used by vehicles to gain access to, and to manoeuvre into and out of parking spaces.

1.3.17 Parking module

A parking aisle together with a single row of parking spaces on one or both sides (see Figure 2.1), but excluding any ramps or circulation roadways which take off within the module.

1.3.18 Parking space

The area of pavement required to park one vehicle.

1.3.19 Private car park

A car park (e.g. at a residential development or place of employment) which is not open to or intended to be used by the public or casual users.

1.3.20 Queuing area

The area of a circulation roadway between the property boundary and the vehicle control point, available for the queuing of vehicles.

1.3.21 Ramp

A circulation roadway which connects an access driveway to an off-street car park on a substantially different level, or which connects two levels in a multi-level car park (see Figure 2.1).

1.3.22 Rear overhang

The distance between the centre-line of the rear axle of a vehicle and the rear extremity of the bodywork.

A1

1.3.23 Residential property

A property having more than three domestic units.

1.3.24 Road

The entire width of a right-of-way between property boundaries, and including footpaths.

1.3.25 Roadway

Any one part of the width of a public road or a vehicular traffic path in an off-street car park devoted particularly to the use of vehicles, inclusive of shoulders and auxiliary lanes, but exclusive of parking spaces.

1.3.26 Shall

Indicates that a statement is mandatory.

1.3.27 Should

Indicates a recommendation.

1.4 CLASSIFICATION OF OFF-STREET CAR PARKING FACILITIES

Off-street parking facilities shall be classified according to the user classes listed in the first column of Table 1.1. Dimensional requirements for parking spaces in each user class are specified in Clause 2.4.1.

User Class 1A parking shall be restricted to residential, domestic and employee parking.

User Class 4 parking shall be restricted to use by people with disabilities (see AS/NZS 2890.6*).

* In preparation. See footnote to Clause 1.2.

TABLE 1.1
CLASSIFICATION OF OFF-STREET CAR PARKING FACILITIES

User class	Required door opening	Required aisle width	Examples of uses (Note 1)
1	Front door, first stop	Minimum for single manoeuvre entry and exit	Employee and commuter parking (generally, all-day parking)
1A	Front door, first stop	Three-point turn entry and exit into 90° parking spaces only, otherwise as for User Class 1	Residential, domestic and employee parking
2	Full opening, all doors	Minimum for single manoeuvre entry and exit	Long-term city and town centre parking, sports facilities, entertainment centres, hotels, motels, airport visitors (generally medium-term parking)
3	Full opening, all doors	Minimum for single manoeuvre entry and exit	Short-term city and town centre parking, parking stations, hospital and medical centres
3A	Full opening, all doors	Additional allowance above minimum single manoeuvre width to facilitate entry and exit	Short term, high turnover parking at shopping centres
4	Size requirements are specified in AS/NZS 2890.6 (Note 2)		Parking for people with disabilities

NOTES:

- 1 Except for the requirements specified in Clause 1.4 relating to User Classes 1A and 4, the examples of uses are intended to be flexible and allow for progressive improvement both in the ease of manoeuvring into and out of parking spaces, and in leaving and re-entering the vehicle as one progresses up the user class scale from 1 to 3A. The modelling of vehicle manoeuvring into Class 1A spaces shows however, that many drivers may have difficulty driving into and out of such spaces, especially those with vehicles larger than the B85 vehicle. Furthermore, they may have difficulty entering and leaving the vehicle in the narrower spaces. Safety issues associated with delays and congestion caused by manoeuvres into and out of Class 1A spaces in large parking areas should also be taken into account. See also Appendix B, Paragraph B4.8.
- 2 In preparation, see footnote to Clause 1.2.

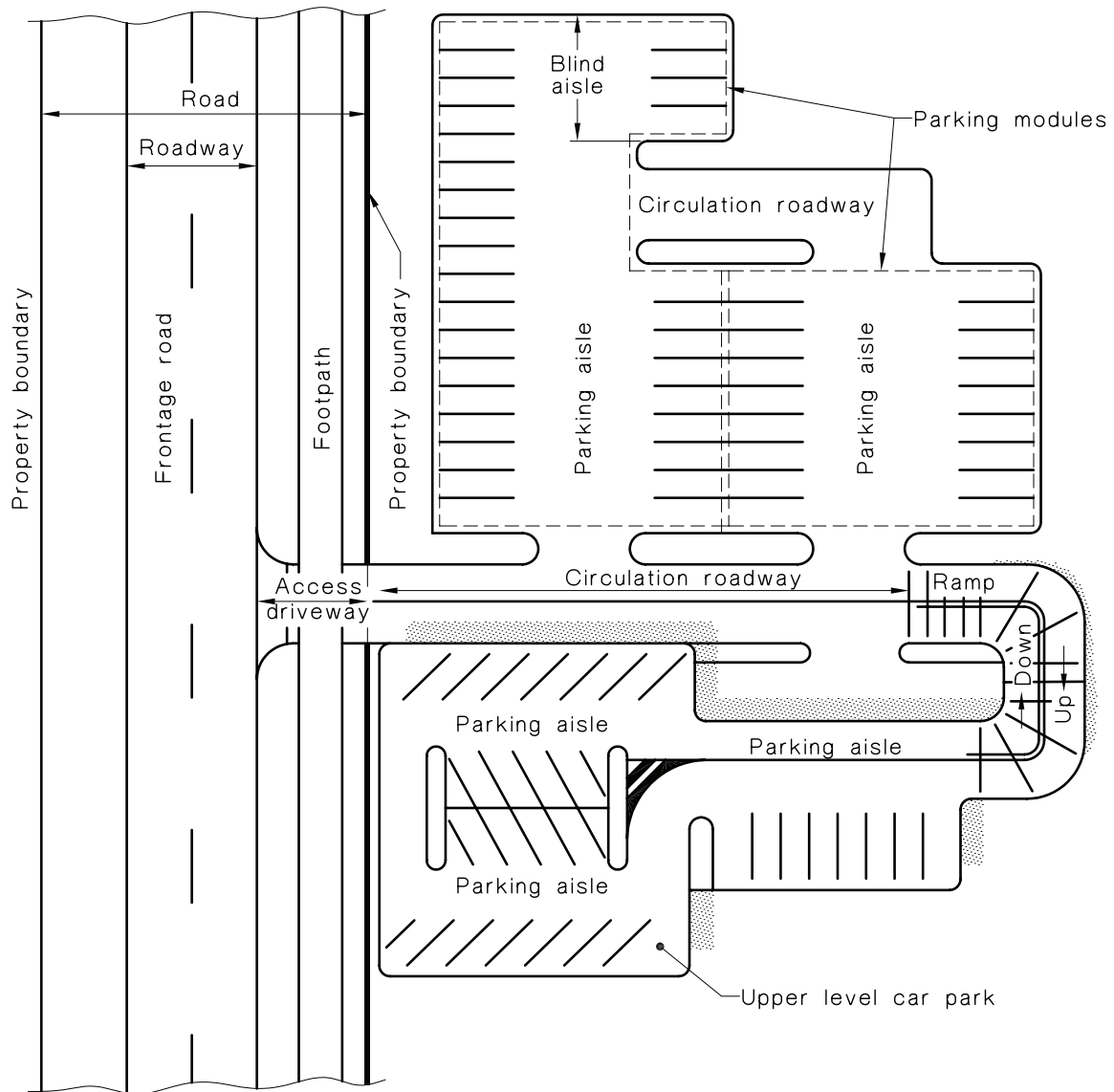
SECTION 2 DESIGN OF PARKING MODULES, CIRCULATION ROADWAYS AND RAMPS

2.1 GENERAL

This Section gives requirements and recommendations to be used in the design of parking modules and circulation roadways within off-street car parking facilities in accordance with the vehicle characteristics discussed in Appendix A and the base dimensions specified in Appendix B.

2.2 GENERAL DESCRIPTION

An example of an off-street car park illustrating the various elements which make up the parking modules and access paths, together with the terms used to describe each of the elements, is shown in Figure 2.1.



NOTE: A proportion of parking spaces for people with disabilities is required to be located near the accessible entrance to the development the car park serves.

FIGURE 2.1 EXAMPLE OF AN OFF-STREET CAR PARK

2.3 PRELIMINARY DESIGN CONSIDERATIONS

2.3.1 Design coordination

The layout design of an off-street car park shall consider the entire facility, including parking modules, circulation roadways, access driveways and, if necessary, frontage road access, as an integrated and co-ordinated design. Provision for traffic within a parking facility shall take into account the following:

- The need for traffic to move to and from the frontage road with minimum disruption to through traffic and maximum pedestrian safety.
- Provision of adequate capacity in circulation roadways and parking aisles to handle peak period movements.
- Arrangement of internal roadways to avoid, as far as practicable, conflicts between intersecting streams of circulating traffic.
- Provision of minimum length travel paths between entry/exit points and parking spaces.

- (e) Safe treatment of points of conflict with pedestrians and other road users.
- (f) Provision of parking spaces and accessible pedestrian paths for people with disabilities (see AS/NZS 2890.6*).

2.3.2 Parking angle

Parking angles used in off-street car parks shall be as follows:

(a) *90 degree angle parking*

Parking aisles for 90 degree parking shall be designed for two-way movement even though one-way movement may need to be imposed in some instances.

NOTE: 90 degree parking will in most cases be found to be the most efficient use of space in a large area.

(b) *30, 45 or 60 degree angle parking*

Where space is limited or does not lend itself to 90 degree parking, 30, 45 or 60 degree parking may be used instead. Aisles serving such spaces shall be one-way (except where parallel parking is allowed on one side, see Clause 2.4.4) with forward entry into the spaces only.

NOTE: Such arrangements can have advantages for high turnover parking provided drivers are discouraged from entering aisles the wrong way and reversing into parking spaces.

(c) *Parallel parking*

Parallel parking shall be provided as set out in Clause 2.4.4.

2.3.3 Parking aisle length

If a parking aisle exceeds 100 m in length, (i.e. more than about 40 × 90 degree parking spaces on either side) traffic control devices such as speed humps (see Clause 4.9) shall be placed along the parking aisle to control vehicle speeds. Where vehicle negotiation of such devices may lead to structural damage, compliance with this requirement may be waived.

NOTE: To limit traffic volumes and consequent congestion in parking aisles to acceptable levels it is good practice not to have parking aisles provide access for circulating traffic to other parking aisles where those aisles together have more than 50 parking spaces for a Class 3 or 3A facility, 75 for a Class 2 facility or 100 for a Class 1 or 1A facility. Circulation roadways should be provided in lieu.

2.3.4 Assignment of user class to parking modules

The user class shall be assigned to parking modules according to the appropriate classification specified in Clause 1.4.

Any one parking module in other than a private car park shall comprise spaces for one user class only, with the exception that spaces for people with disabilities and spaces for small cars, see Clause 2.4.1, may be added to any module.

NOTE: The provision of a higher class module for a relatively small number of users in that class can be avoided by creating a separate module for that class (e.g. a visitors' car park separate from an employees' car park). The separate purposes may need to be clearly signposted.

In a private car park a single module catering for a mixture of classes (e.g. employees plus visitors) may be used provided that the spaces for each separate class are grouped together.

* In preparation. See footnote to Clause 1.2.

2.4 DESIGN OF PARKING MODULES

2.4.1 Angle parking spaces

Dimensions of angle parking spaces shall be as shown in Figure 2.2 subject to the following exceptions:

- (a) *Length* The nominal length of a parking space in a parking module shall be 5.4 m min except as follows:
 - (i) *End overhang* Where a vehicle may overhang the end of a space, e.g. at a kerb, provided the first 600 mm immediately behind it is unobstructed, is not another parking space and is not required as a footway or for some similar purpose, space lengths measured parallel to the parked vehicle may be reduced by 600 mm. Ends of bays shall be provided with wheel stops if the requirements specified in Clause 2.4.5.4 apply.
 - (ii) *In New Zealand* The space may be marked to a shorter length (nominally 5.0 m) as specified in Clause 4.4.1. There shall be no consequential reduction in the combined length of space and width of parking aisle from that given in Figure 2.2.
 - (iii) *Spaces for small cars* In certain circumstances it may be appropriate to provide a space smaller than specified above for small cars. It shall be designated as a space for small cars.

NOTE: The size of such spaces is based on small car vehicle dimensions recommended in Appendix A, Paragraph A6.

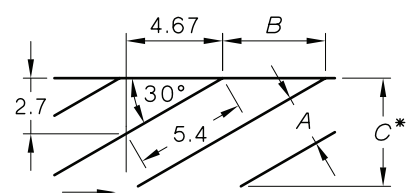
The minimum dimensions shall be as follows:

- (A) In Australia—2.3 m wide × 5.0 m long.
 - (B) In New Zealand—2.3 m wide × 4.5 m long.
- (b) *Width* The minimum width of parking spaces required for each user class is shown in Figure 2.2 except as follows:
 - (i) *Spaces for small cars* The specified minimum width is given in Item (a)(iii).
 - (ii) *Adjacent obstruction* If the side boundary of a space is a wall or fence, or if there are obstructions such as columns placed so as to restrict door opening, 300 mm shall be added to the width of the space.
 - (iii) *Parking spaces for people with disabilities* See AS/NZS 2890.6*.

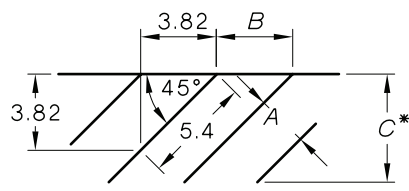
Attention is also drawn to the reduced width requirement for 30 degree parking as shown in Figure 2.2.

In the design of buildings or parts of buildings to be used exclusively as parking stations, the location of obstructions such as columns shall be in accordance with Clause 5.2.

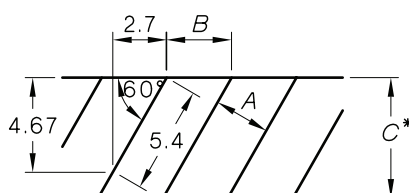
* In preparation. See footnote to Clause 1.2.



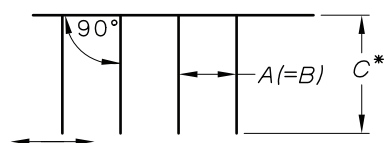
(a) Bays at 30°



(b) Bays at 45°



(c) Bays at 60°



(d) Bays at 90°

User class (Note 1)	A (Notes 2 & 3)	B	C ₁	C ₂	C ₃	Aisle width
1,1A	2.1	4.2	4.4	4.1	4.5	3.1
2	2.3	4.6	4.4	4.1	4.7	3.0
3	2.5	5.0	4.4	4.1	4.9	2.9
3A	2.5	5.0	4.4	4.1	4.9	3.45

User class (Note 1)	A (Note 3)	B	C ₁	C ₂	C ₃	Aisle width
1,1A	2.4	3.4	5.2	4.8	5.5	3.9
2	2.5	3.5	5.2	4.8	5.6	3.7
3	2.6	3.7	5.2	4.8	5.7	3.5
3A	2.6	3.7	5.2	4.8	5.7	4.2
4	(See Note 5)					

User class (Note 1)	A (Note 3)	B	C ₁	C ₂	C ₃	Aisle width
1,1A	2.4	2.75	5.7	5.1	5.9	4.9
2	2.5	2.90	5.7	5.1	6.0	4.6
3	2.6	3.00	5.7	5.1	6.0	4.3
3A	2.6	3.00	5.7	5.1	6.0	5.1
4	(See Note 5)					

User class (Note 1)	A (Note 3)	B	C ₁	C ₂	C ₃	Aisle width (Note 4)
1	2.4	2.4	5.4	4.8	5.4	6.2
1A	2.4	2.4	5.4	4.8	5.4	5.8
2	2.5	2.5	5.4	4.8	5.4	5.8
3	2.6	2.6	5.4	4.8	5.4	5.8
3A	2.6	2.6	5.4	4.8	5.4	6.6
3A	2.7	2.7	5.4	4.8	5.4	6.2
4	(See Note 5)					

*Dimension C is selected as follows (see Note 6):

C₁—where parking is to a wall or high kerb not allowing any overhang.

C₂—where parking is to a low kerb which allows 600 mm overhang in accordance with Clause 2.4.1(a)(i).

C₃—where parking is controlled by wheelstops installed at right angles to the direction of parking, or where the ends of parking spaces form a sawtooth pattern, e.g. as shown in the upper half of Figure 2.4(b).

For Notes—see over.

DIMENSIONS IN METRES

FIGURE 2.2 LAYOUTS FOR ANGLE PARKING SPACES

NOTES TO FIGURE 2.2:

- 1 User class is defined in Table 1.1. The two Class 3A options given for 90 degree parking are alternatives of equal standing.
- 2 30 degree parking spaces can be made narrower than spaces at other angles because of the reduced chance of open doors hitting adjacent vehicles.
- 3 The design envelope around each parking space, to be kept clear of obstructions, is shown in Figure 5.2.
- 4 Dimensions for 90 degree parking aisles are for two-way aisles. These dimensions are required to be observed even though one-way movement along aisles is imposed for other purposes, see Clause 2.3.2(a).
- 5 Space dimensions for User Class 4 spaces (for people with disabilities) are specified in AS/NZS 2890.6*. Aisle widths shall be the same as applicable to adjacent other-user spaces or in the absence of such spaces, 5.8 m minimum.
- 6 The values for dimension C have been calculated as follows:

$$C_1 = 5.4 \sin \theta + 1.9 \cos \theta$$

$$C_2 = C_1 - 0.6 \sin \theta$$

$$C_3 = C_1 + (A - 1.9) \cos \theta$$

where

θ = parking angle

A = space width, in metres

2.4.2 Angle parking aisle

The width of angle parking aisles is determined from either the width needed for circulating traffic or the width needed to manoeuvre into and out of a parking space. In the latter case, the width will vary according to the width of the parking spaces, wider spaces needing less aisle width for the parking manoeuvre. Minimum aisle widths shall be as shown in Figure 2.2. These widths will cater both for the angle parking manoeuvre or for circulating traffic, two-way in the case of 90 degree parking and one-way in the case of 30, 45 and 60 degree parking. For aisles where there is parallel parking on one or both sides, see Clause 2.4.4.

When designing for turns between an aisle and a ramp or circulation roadway, or between two aisles, adequate area shall be provided for the turning movements (see Clause 2.5.2(c)).

The following additional requirements shall apply:

- (a) *Class 1A aisles* Class 1A aisles apply to 90° parking only. Minimum aisle widths are shown in Figure 2.2.

NOTE: These may be of lesser width than those for user Class 1 aisles and may not allow access into parking spaces in a single manoeuvre by some vehicles, see Appendix B, Paragraph B4.8.

- (b) *Class 3A aisles* To cater for expected higher turnover than other User Class 3 parking areas, User Class 3A parking spaces or aisle widths shall be increased in size as shown in Figure 2.2.

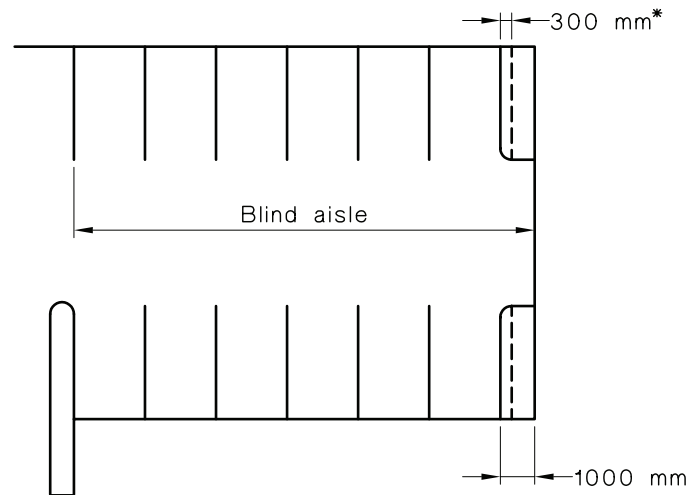
- (c) *Blind aisles* At blind aisles, the aisle shall be extended a minimum of 1 m beyond the last parking space, as shown in Figure 2.3, and the last parking space widened by at least 300 mm if it is bounded by a wall or fence.

NOTE: Where practicable the space should be widened by the same amount as the aisle is lengthened.

In car parks open to the public, the maximum length of a blind aisle shall be equal to the width of six 90 degree spaces plus 1 m, unless provision is made for cars to turn around at the end and drive out forwards.

* In preparation. See footnote to Clause 1.2.

- (d) *Single-sided aisles* Where there is angle parking on one side of an aisle only and the other side is confined by a wall or other high vertical obstruction closer than 300 mm to the nominal edge of the aisle, to provide manoeuvring clearance, the aisle width shall be increased by 300 mm, measured to the vertical obstruction.



*Additional widening required if there is a wall or fence at the side of the last space, see Clause 2.4.1(b)(ii).

DIMENSIONS IN MILLIMETRES

FIGURE 2.3 BLIND AISLE EXTENSION

2.4.3 Angle parking module layout

Layouts of typical angle parking modules are shown in Figure 2.4.

2.4.4 Parallel parking in parking aisles

Where parallel parking is to be provided on one or both sides of a parking aisle the following shall apply:

- (a) *Parallel parking one or both sides, one-way or two-way aisle*

Layout requirements for parallel parking on one or both sides of a one-way aisle shall be as set out in Figure 2.5.

Where the aisle is two-way but parking is on one side only, its width shall be increased by 3.0 m minimum.

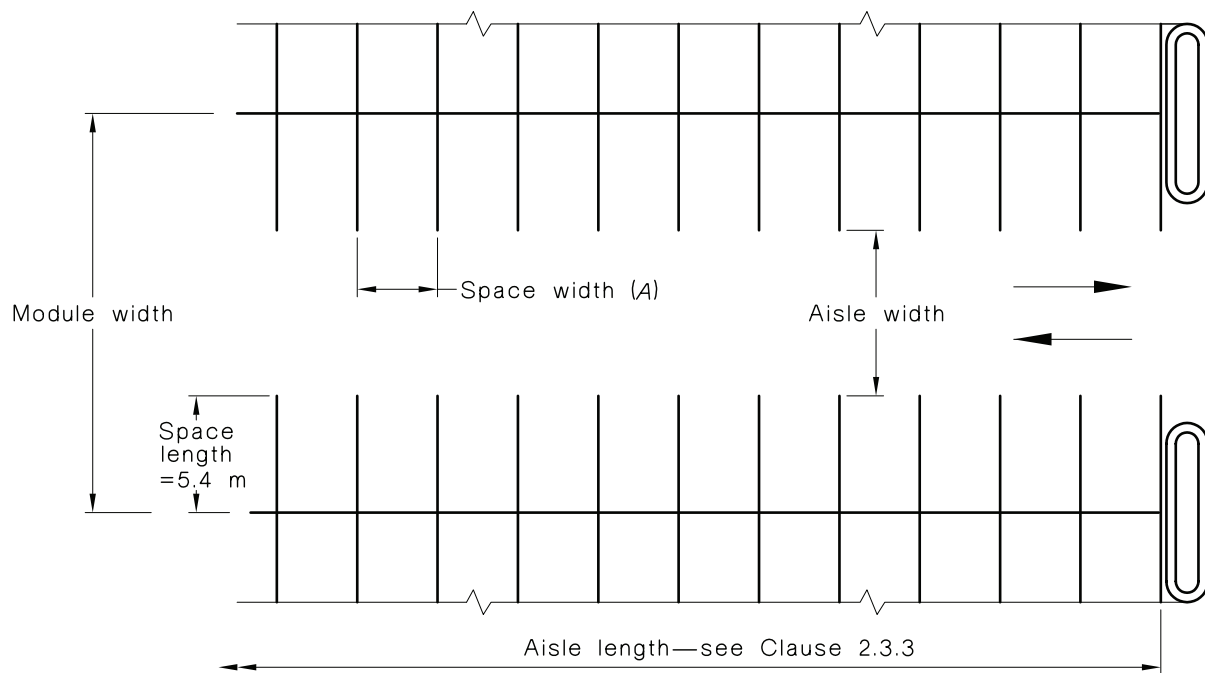
Where parallel parking is provided on both sides of a two-way aisle, the aisle widths shown in Figure 2.5 shall be provided on each side of the aisle centre-line.

For parallel parking on both sides of a one-way aisle the aisle width shall be at least twice that shown in Figure 2.5.

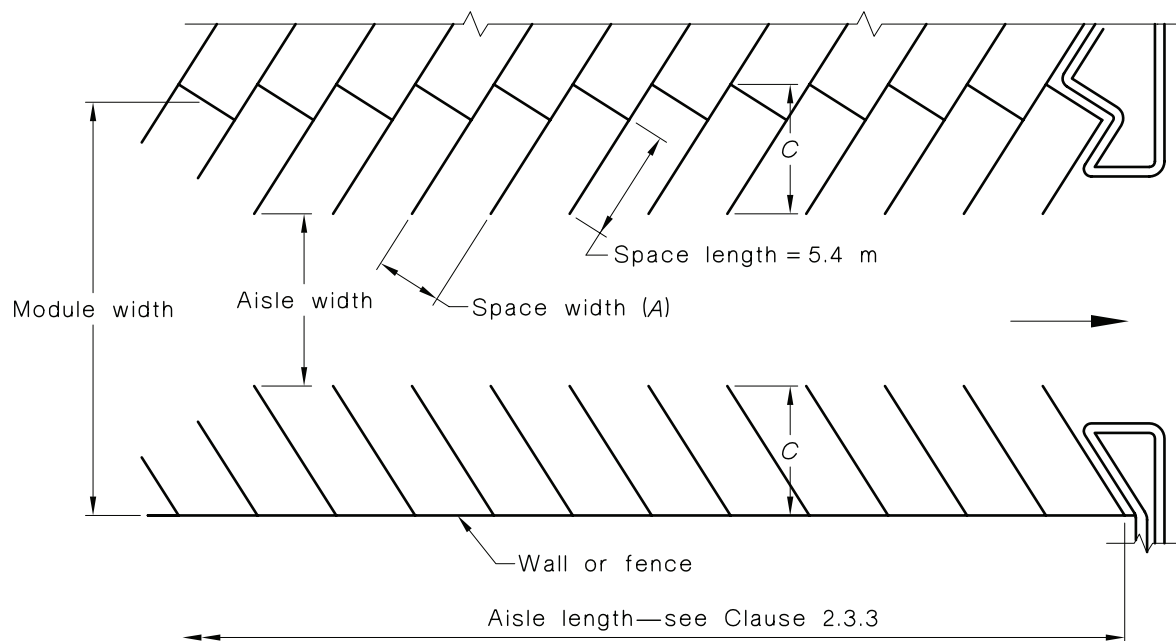
- (b) *Parallel parking one side, angle parking the other, one-way or two-way aisle* Requirements shall be as follows:

- (i) Angle parking space depths shall be as shown for dimension C on Figure 2.2.
- (ii) Parallel parking space dimensions shall be as shown on Figure 2.5.
- (iii) Aisle width shall be that shown on Figure 2.2 plus a further 0.5 m.
- (iv) Steps shall be taken to discourage reverse-in parking where the angle parking angle is other than 90 degrees.

NOTE: Suitable steps might include making the aisle one-way or signposting the angle parking spaces as front-in only.



(a) 90 degree parking

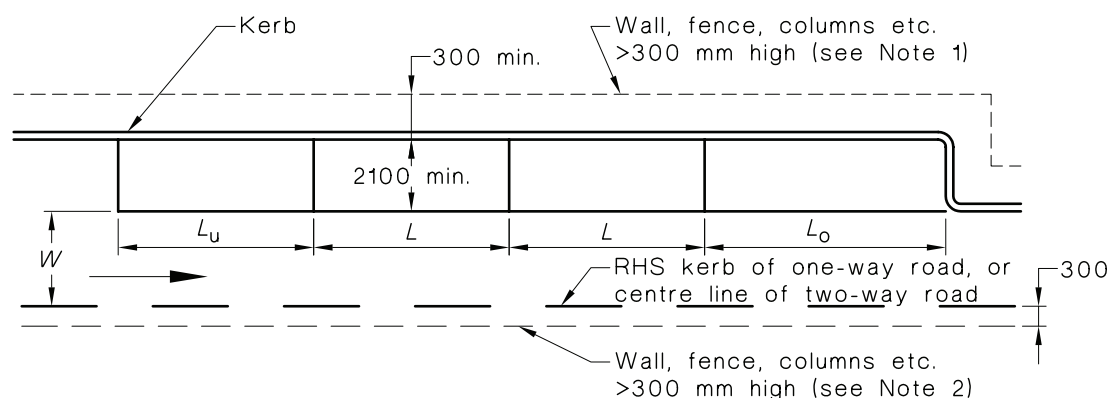


(b) Parking angle other than 90 degrees

Dimensions A and C are as shown in Figure 2.2

NOTE: See also Clause 4.4.1 regarding marking of spaces.

FIGURE 2.4 ANGLE PARKING MODULE LAYOUTS



metres			
Aisle width (one-way), W	Space length, L	Space length obstructed end spaces, L_o	Space length unobstructed end spaces, L_u (Note 4)
3.0	6.3	6.6	5.4
3.3	6.1	6.4	5.4
3.6	5.9	6.2	5.4

NOTES:

- 1 Spaces shall be located at least 300 mm clear of obstructions higher than 150 mm such as walls, fences and columns.
- 2 Where the opposite side of the aisle is bounded by obstructions higher than 150 mm, Dimension W shall be increased by at least 0.3 m.
- 3 If a single space is obstructed at both ends, a further 0.3 m shall be added to dimensions in this column.
- 4 In New Zealand only, space lengths in this column may be reduced to 5.0 m.

FIGURE 2.5 MINIMUM SPACE LENGTH AND AISLE WIDTH COMBINATIONS
FOR PARALLEL PARKING MANOEUVRE

2.4.5 Physical controls

2.4.5.1 General description

The need for the following physical controls shall be considered:

- Kerbs**—on one or more sides of a parking space to protect pedestrian walkways, landscaped areas, and any other non-trafficable areas generally at or just above pavement level, from encroachment.
- Barriers**—to contain vehicles at the edges of platforms or decks, or to prevent encroachment onto pedestrian facilities.
- Wheel stops**—to limit the travel of vehicles when manoeuvring into a parking space.
NOTE: Wheel stops should be avoided in any situation where they may be in the path of pedestrians or wheelchairs moving to or from parked vehicles, or crossing a car park for any other purpose.
- Other protective devices**—to prevent damage to structural elements or other unwanted vehicle encroachment.

Physical controls shall not obstruct accessible travel paths for people with disabilities.

All kerbs, wheel stops, low barriers and other obstructions that could be a tripping hazard to pedestrians shall be surfaced in a colour contrasting with their surroundings.

2.4.5.2 Kerbs

Vehicles may be allowed to park overhanging a kerb at the rear of a parking space, provided that—

- (a) the kerb is not more than 150 mm high;
- (b) the area up to 1.2 m behind the kerb does not slope up from the kerb; and
- (c) the walkway behind the kerb would not be obstructed. (See also Clause 2.4.1(a)(i).)

If overhang cannot be tolerated, wheel stops (see Clause 2.4.5.4) shall be provided. Kerbs in vulnerable locations may require additional devices such as bollards to make them visible to car drivers.

2.4.5.3 Barriers

Barriers shall be constructed to prevent vehicles from running over the edge of a raised platform or deck of a multi-storey car park including the perimeter of all decks above ground level. They are required wherever the drop from the edge of the deck to a lower level exceeds 600 mm. At drops between 150 mm and 600 mm, wheel stops (see Clause 2.4.5.4) shall be provided. Barriers shall comply with the following requirements:

- (a) They shall be designed structurally for the loading requirements of AS/NZS 1170.1.
- (b) If at the end of a parking space, they shall be at least 1.3 m high so that drivers of cars backing into the space can see the barrier above the rear of the car.

NOTE: The upper portion of such a barrier may be a light structure provided for sighting purposes only.

- (c) They shall not be made from brickwork, unreinforced concrete or other materials likely to shatter on impact.

2.4.5.4 Wheel stops

Wheel stops may be provided where it is considered necessary to limit the travel of a vehicle into a parking space. If used they shall meet the requirements given below.

NOTES:

- 1 Typical uses of wheel stops are as follows:
 - (a) Control of kerb overhang where inconvenient or hazardous for pedestrians.
 - (b) Inhibiting contact with an end barrier or high kerb.
 - (c) Inhibiting encroachment into an opposing parking space.
- 2 Wheel stops should be avoided in any situation where they may be in the path of pedestrians moving to or from parked vehicles, or crossing a car park for any other purpose.

Wheel stops shall be between 90 and 100 mm in height, and 1650 ± 50 mm in width.

Where reverse-in parking is unlikely, e.g. at 30, 45 and 60 degree angle parking modules with one-way aisles, or where occasional minor encroachment (up to about 400 mm) by a reverse-in vehicle can be tolerated, e.g. over a kerb, wheel stop positions shall be set at the *front-in* position. If reverse-in parking is likely and encroachment over the end of the parking space cannot be tolerated, wheel stop positions shall be set at the *rear-in* position and all vehicles required to back in. Location of wheel stops with respect to the front of parking spaces is given in Table 2.1 and illustrated in Figure 2.6.

If wheel stops are provided to restrain vehicle contact with a kerb higher than 150 mm or a wall, a further 200 mm shall be added to the wheel stop distance to cater for the B99 vehicle, as illustrated in Figure 2.6(c) and (d).

TABLE 2.1
WHEEL STOP DISTANCES

millimetres

Parking direction	Wheel stop distance to front of parking space			
	Parking to kerb ≤150 high		Parking to kerb >150 high or wall	
	Wheel stop height		Wheel stop height	
	90	100	90	100
Front-in	630	620	830	820
Rear-in	910	900	1110	1100

NOTE: The distances in this table are calculated from the formula:

$$S = C + O - \sqrt{r^2 - (r - d - H)^2}$$

where

S = wheel stop distance (measured to point of contact with vehicle tyre)

C = clearance (to low kerb—nil; to high kerb or wall—200 mm)

O = overhang of B85 vehicle (front—820 mm; rear—1100 mm)

r = radius of wheel (225 mm)

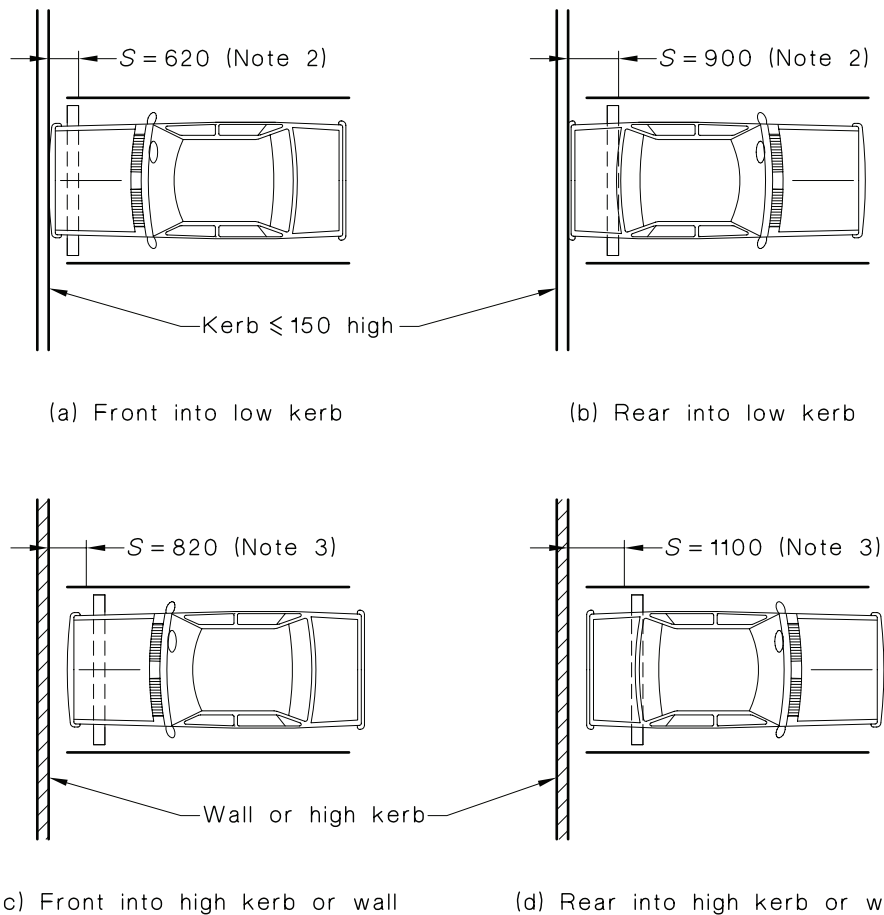
d = tyre deflection under load (20 mm)

H = wheel stop height

2.4.5.5 Other protective devices

Protective devices shall be provided as necessary to protect parts of the building or other fixed objects or equipment from damage by vehicles. Such protection shall include devices to prevent vehicle encroachment into pedestrian ways, stairs, doorways, lifts and the like. Appropriately located bollards are suitable for these purposes. Protective devices shall be clearly visible to drivers when in their normal driving position.

NOTE: Design impact forces are given in AS/NZS 1170.1.



S = wheel stop distance (measured to point of contact with vehicle tyre).

NOTES:

- 1 Wheel stop distances shown in this Figure are for 100 mm high wheel stops (see also Table 2.1).
- 2 Wheel stop distances are set for the B85 vehicle. Some kerb overlap may occur if either a longer vehicle or, in the case of Figure 2.6(a), an occasional reverse-in vehicle, uses the space.
- 3 Wheel stop distances are set to allow 200 mm clearance to the wall for the B85 vehicle. The clearance will be almost zero for the B99 vehicle.

FIGURE 2.6 LOCATION OF WHEEL STOPS

2.4.6 Gradients within parking modules

2.4.6.1 Maximum gradients

The maximum gradients within a parking module including a motorcycle parking area shall be as follows:

- (a) Measured parallel to the angle of parking—1 in 20 (5%).
- (b) Measured in any other direction—1 in 16 (6.25%).
- (c) Within parking spaces for people with disabilities—see AS/NZS 2890.6*.

2.4.6.2 Minimum gradients

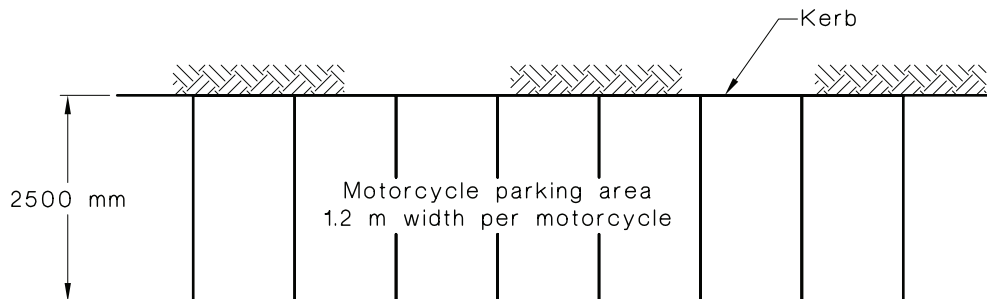
So that parking floors will drain adequately, the minimum gradient shall be 1 in 100 (1.0%) for outdoor areas and 1 in 200 (0.5%) for covered areas.

* In preparation. See footnote to Clause 1.2.

2.4.7 Provision for motorcycles

The recommended minimum provision for motorcycles is shown in Figure 2.7.

Motorcycle parking areas should not be located so that parked motorcycles are vulnerable to being struck by a manoeuvring car.



NOTE: Transverse bay markings will usually be needed to control space usage and parking angle.

FIGURE 2.7 MOTORCYCLE PARKING PROVISION

2.5 DESIGN OF CIRCULATION ROADWAYS AND RAMPS

2.5.1 General

Circulation roadways and ramps provide access between the car park entry/exit points and parking modules. They also provide for traffic circulating between parking modules. In small car parks, not larger than 50 parking spaces, access from a frontage road may be direct to the parking module.

NOTE: Parking aisles should not be used to provide access to other parking aisles where the restrictions recommended in the Note to Clause 2.3.3 apply.

2.5.2 Layout design of circulation roadways and ramps

Cross sections of circulation roadways and ramps shall be as illustrated in Figure 2.8. Design requirements and dimensions shall be as follows:

- (a) *Straight roadways and ramps*—as follows:
- (i) One-way roadways or ramps—3.0 m minimum between kerbs (see also Item (c)).
 - (ii) Two-way roadways or ramps—5.5 m minimum between kerbs (see also Item (c)).
 - (iii) Double roadways or ramps—where there are to be two parallel roadways or ramps, separated by a raised median or separator, each roadway or ramp shall be designed as a one-way roadway or ramp, and the median or separator shall be 600 mm minimum in width and between 125 mm and 150 mm in height, the preferred height being 125 mm.

Where there is to be a kerb or barrier higher than 150 mm and closer than 300 mm from one edge of the roadway or ramp, the roadway or ramp shall be widened to provide a minimum of 300 mm clearance to the obstruction. If there is to be a high kerb or barrier on both sides, the width increase shall be sufficient to provide 300 mm on both sides.